

CALIFORNIA HIGH-SPEED TRAIN

Program Environmental Impact Report/Environmental Impact Statement

Sacramento to Bakersfield Region

GEOLOGY & SOILS TECHNICAL EVALUATION

January 2004

Prepared for:

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CALIFORNIA HIGH-SPEED TRAIN PROGRAM EIR/EIS

Sacramento to Bakersfield Region Geology and Soils Technical Evaluation

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ACRONYMS

AUTHORITY	CALIFORNIA HIGH-SPEED RAIL AUTHORITY
CEQA	CALIFORNIA ENVIRONMENTAL QUALITY ACT
COG	COUNCIL OF GOVERNMENTS
CGS	CALIFORNIA GEOLOGIC SURVEY
EIR	ENVIRONMENTAL IMPACT REPORT
EIS	ENVIRONMENTAL IMPACT STATEMENT
EPA	ENVIRONMENTAL PROTECTION AGENCY
FAA	FEDERAL AVIATION ADMINISTRATION
FHWA	FEDERAL HIGHWAY ADMINISTRATION
FRA	FEDERAL RAILROAD ADMINISTRATION
FTA	FEDERAL TRANSIT ADMINISTRATION
HST	HIGH SPEED TRAIN
MTA	METROPOLITAN TRANSPORTATION AUTHORITY
RTP	REGIONAL TRANSPORTATION PLAN
USGS	UNITED STATES GEOLOGIC SURVEY

1.0 INTRODUCTION

The California High-Speed Rail Authority (Authority) was created by the Legislature in 1996 to develop a plan for the construction, operation, and financing of a statewide, intercity high-speed passenger train system.¹ After completing a number of initial studies over the past six years to assess the feasibility of a high-speed train system in California and to evaluate the potential ridership for a variety of alternative corridors and station areas, the Authority recommended the evaluation of a proposed high-speed train system as the logical next step in the development of California's transportation infrastructure. The Authority does not have responsibility for other intercity transportation systems or facilities, such as expanded highways, or improvements to airports or passenger rail or transit used for intercity trips.

The Authority adopted a *Final Business Plan* in June 2000, which reviewed the economic feasibility of a 1,127-kilometer-long (700-mile-long) high-speed train system. This system would be capable of speeds in excess of 321.8 kilometers per hour (200 miles per hour [mph]) on a dedicated, fully grade-separated track with state-of-the-art safety, signaling, and automated train control systems. The system described would connect and serve the major metropolitan areas of California, extending from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego. The high-speed train system is projected to carry a minimum of 42 million passengers annually (32 million intercity trips and 10 million commuter trips) by the year 2020.

Following the adoption of the Business Plan, the appropriate next step for the Authority to take in the pursuit of a high-speed train system is to satisfy the environmental review process required by federal and state laws which will in turn enable public agencies to select and approve a high speed rail system, define mitigation strategies, obtain necessary approvals, and obtain financial assistance necessary to implement a high speed rail system. For example, the Federal Railroad Administration (FRA) may be requested by the Authority to issue a *Rule of Particular Applicability*, which establishes safety standards for the high-speed train system for speeds over 200 mph, and for the potential shared use of rail corridors.

The Authority is both the project sponsor and the lead agency for purposes of the California Environmental Quality Act (CEQA) requirements. The Authority has determined that a Program Environmental Impact Report (EIR) is the appropriate CEQA document for the project at this conceptual stage of planning and decision-making, which would include selecting a preferred corridor and station locations for future right-of-way preservation and identifying potential phasing options. No permits are being sought for this phase of environmental review. Later stages of project development would include project-specific detailed environmental documents to assess the impacts of the alternative alignments and stations in those segments of the system that are ready for implementation.

The decisions of federal agencies, particularly the Federal Railroad Administration (FRA) related to high-speed train systems, would constitute major federal actions regarding environmental review under the National Environmental Policy Act (NEPA). NEPA requires federal agencies to prepare an Environmental Impact Statement (EIS) if the proposed action has the potential to cause significant environmental impacts. The proposed action in California warrants the preparation of a Tier 1 Program-level EIS under NEPA, due to the nature and scope of the comprehensive high-speed train system proposed by the Authority, the need to narrow the range of alternatives, and the need to protect/preserve right-of-way in the future. FRA is the federal lead agency for the preparation of the Program EIS, and the Federal Highway Administration (FHWA), the U.S. Environmental Protection Agency (EPA), the U.S. Corps of Engineers (USACE), the Federal Aviation Administration (FAA), the U.S. Fish and Wildlife Service (USFWS), and the Federal Transit Administration (FTA) are cooperating federal agencies for the EIS.

¹ Chapter 796 of the Statutes of 1996; SB 1420, Kopp and Costa

A combined Program EIR/EIS is to be prepared under the supervision and direction of the FRA and the Authority in conjunction with the federal cooperating agencies. It is intended that other federal, state, regional, and local agencies will use the Program EIR/EIS in reviewing the proposed program and developing feasible and practicable programmatic mitigation strategies and analysis expectations for the Tier 2 detailed environmental review process which would be expected to follow any approval of a high speed train system.

The statewide high-speed train system has been divided into five regions for study: Bay Area-Merced, Sacramento-Bakersfield, Bakersfield-Los Angeles, Los Angeles-San Diego via the Inland Empire, and Los Angeles-Orange County-San Diego. This Soils and Geology Technical Evaluation for the Sacramento to Bakersfield region is one of five such reports being prepared for each of the regions on the topic, and it is one of several technical reports for this region. This report will be summarized in the Program EIR/EIS and it will be part of the administrative record supporting the environmental review of alternatives.

1.1 ALTERNATIVES

1.1.1 No-Project Alternative

The No-Project Alternative serves as the baseline for the comparison of Modal and High-Speed Train alternatives. The No-Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it existed in 1999-2000 and as it would be after implementation of programs or projects currently programmed for implementation and projects that are expected to be funded by 2020. The No-Project Alternative addresses the geographic area serving the same intercity travel market as the proposed high-speed train (generally from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego). The No-Project Alternative satisfies the statutory requirements under CEQA and NEPA for an alternative that does not include any new action or project beyond what is already committed.

The No-Project Alternative defines the existing and future statewide intercity transportation system based on programmed and funded (already in funded programs/financially constrained plans) improvements to the intercity transportation system through 2020, according to the following sources of information:

- State Transportation Improvement Program (STIP)
- Regional Transportation Plans (RTPs) for all modes of travel
- Airport plans
- Intercity passenger rail plans (California Rail Plan 2001-2010, Amtrak Five- and Twenty-year Plans)

Projects within the No-Project Alternative will affect primarily local areas, but some environmental impacts can be expected, many of which will require mitigation measures to reduce the effects in their local areas. Within the 270-mile length of the Sacramento to Bakersfield Region, however, a precise quantification of these local impacts is not feasible at this level of analysis and would not be meaningful as a point of comparison to the overall evaluation of the Modal and HST Alternatives.

1.1.2 Modal Alternative

There are currently only three main options for intercity travel between the major urban areas of San Diego, Los Angeles, the Central Valley, San Jose, Oakland/San Francisco, and Sacramento: vehicles on the interstate highway system and state highways, commercial airlines serving airports between San Diego and Sacramento and the Bay Area, and conventional passenger trains (Amtrak) on freight and/or commuter rail tracks. The Modal/System Alternative consists of expansion of highways, airports, and intercity and commuter rail systems serving the markets identified for the High-Speed Train Alternative. The Modal Alternative uses the same inter-city travel demand (not capacity) assumed under the high-end

sensitivity analysis completed for the high-speed train ridership in 2020. This same travel demand is assigned to the highways and airports and passenger rail described under the No-Project Alternative, and the additional improvements or expansion of facilities is assumed to meet the demand, regardless of funding potential and without high-speed train service as part of the system.

For purposes of comparative analysis, Modal Alternative has been divided into six corridors: from Sacramento to Stockton, from Stockton to Modesto, from Modesto to Merced, from Merced to Fresno, from Fresno to Tulare, and from Tulare to Bakersfield.

1.1.3 High-Speed Train Alternative

The Authority has defined a statewide high-speed train system capable of speeds in excess of 200 miles per hour (mph) (320 kilometers per hour [km/h]) on dedicated, fully grade-separated tracks, with state-of-the-art safety, signaling, and automated train control systems. State of the art high-speed steel-wheel-on-steel-rail technology is being considered for the system that would serve the major metropolitan centers of California, extending from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego.

The High-Speed Train Alternative includes several corridor and station options. A steel-wheel on steel-rail, electrified train, primarily on exclusive right-of-way with small portions of the route on shared track with other rail is planned. Conventional "non-electric" improvements are also being considered along the existing LOSSAN rail corridor from Los Angeles to San Diego. The train track would be either at-grade, in an open trench or tunnel, or on an elevated guideway, depending on terrain and physical constraints.

For purposes of comparative analysis, the HST corridors are described from station-to-station within each region, except where a by-pass option is considered when the point of departure from the corridor defines the end of the corridor segment. The Sacramento to Bakersfield region has been divided into six corridors: Corridor A runs generally from Sacramento to Stockton; Corridor B, from Stockton to Modesto; Corridor C, from Modesto to Merced; Corridor D, from Merced to Fresno; Corridor E, from Fresno to Tulare; and Corridor F, from Tulare to Bakersfield. Within any given corridor, various alignment options have been developed. Each alignment option is named with an alphanumeric designation: The letter corresponds to the corridor, and the number refers to a specific route within that corridor. The corridors and alignment routes for HST for this region are defined and presented in Appendix A.

Figure 1

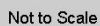


Figure 2



Figure 3
Modal Alternative-Aviation Component

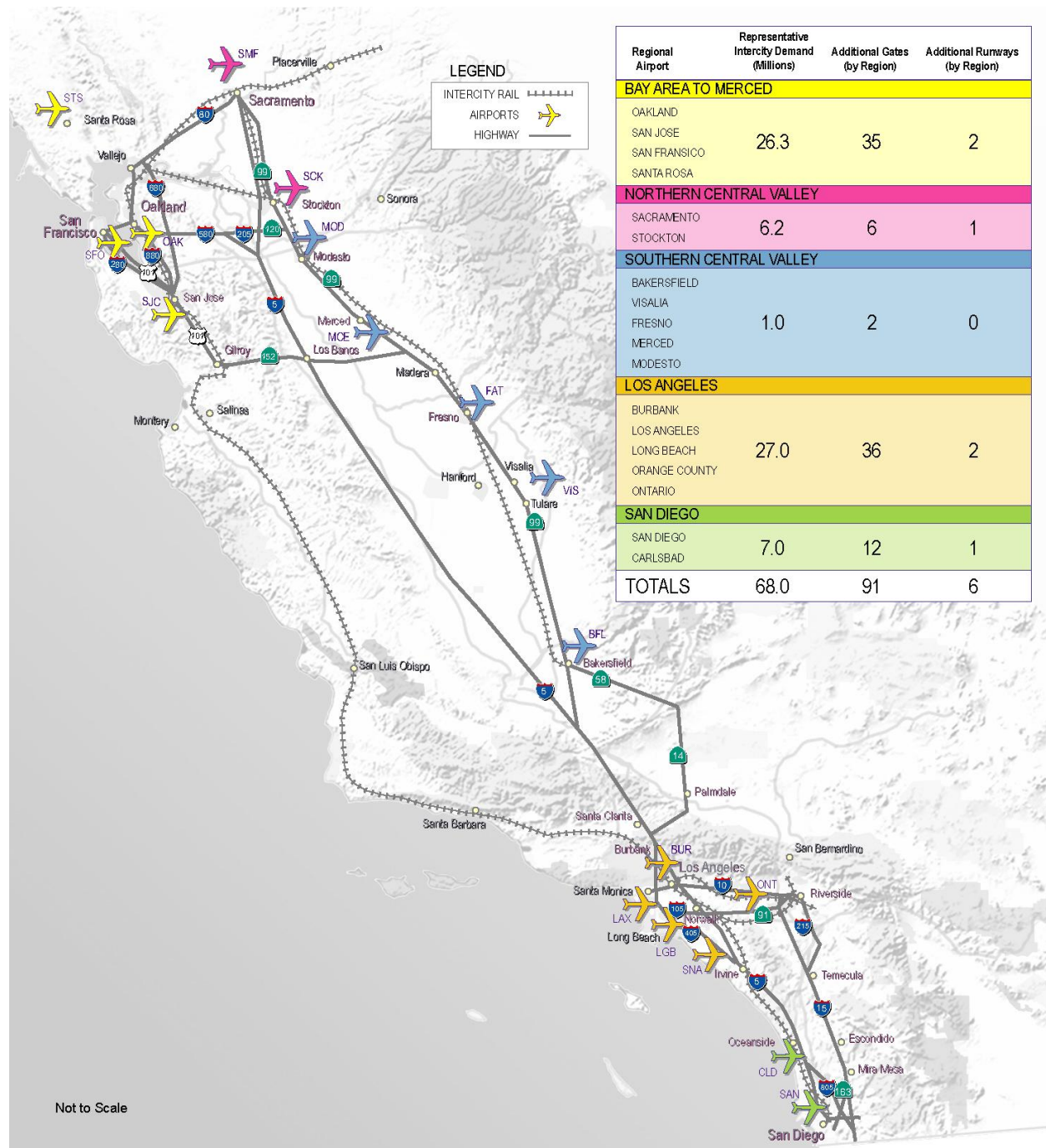


Figure 4
HST Alternative – Corridors and Stations for Continued Investigation



2.0 BASELINE/AFFECTED ENVIRONMENT

2.1 STUDY AREA

The Study Area for geology and soils is defined as 200 ft from corridors (highway alignments and HST alignments) and around facilities (airports for the Modal Alternative, stations for the HST alternative). This 200-foot study area incorporates all cross-sections, with the exception of deep cuts and fills. Comparisons of Project Alternatives were generally made based on length of alignment or number of impact sites within the various geologic conditions and, thus, somewhat different corridor widths did not affect the comparison of alternatives.

2.2 GEOLOGY

2.2.1 Geologic Setting

The Sacramento-Bakersfield segment of the HST traverses relatively uniform, gentle terrain in terms of geologic, soils, and seismic conditions. The segment begins in the Bakersfield area and continues north along the axis of the Central Valley to Sacramento. Regional geology for the study area is shown on Plate 3 (Jennings, 1977, 1991). This location places the majority of the project geologically in the Great Valley of California Geomorphic Province (Norris, 1976). The Great Valley Geomorphic Province is characterized primarily by a long and narrow, north-south trending valley underlain by thousands of feet of alluvial and floodplain deposits. These sediments are largely deposited by river systems still active today that transport eroded materials from the adjacent Sierra Nevada Mountains to the east and Coast Ranges to the west. Deposition has occurred in a huge synclinal, structural trough created during early stages of mountain building of the Sierra Nevada Mountains. Sediments underlying this province are comprised primarily of Cenozoic, alluvium, lake, playa, and terrace deposits.

2.2.2 Topography

Topography along the HST alignments is shown on Plate 2. A broad alluvial basin occupies most of the alignment, separating rugged, mountainous terrain of the Tehachapi Mountains to the south, the Sierra Nevada Mountains to the east, and moderately rugged mountains of the Coast Ranges to the west. Elevations in the Valley along the SR-99 alignment are generally at 10m to 30m above mean sea level (msl). The lowest point along this alignment is in the Stockton-Sacramento area at about 10±m above msl. The south end of the region, Bakersfield, lies at 125±m above msl.

2.2.3 Geologic Materials

Geologic earth units along the study area are shown on Plate 3 (Jennings, 1977, 1991). This map was used in its GIS (Geographic Information System) format for much of the project analysis involving earth units. Geologic materials encountered within the Sacramento to Bakersfield region consist primarily of fluvial and basin deposits. Three primary units have been mapped by Jennings (1977, 1991) including Plio-Pleistocene alluvium (Qs) with isolated areas of Holocene sand deposits (Q), and Plio-Pleistocene terrace deposits and older alluvium (QPc). The nearest bedrock (in plan view) is the granitic terrain of the Sierra Nevada Mountains to the east. Metamorphic rock lies at great depth beneath these valley fluvial deposits.

2.2.4 Groundwater

No attempt was made to contour or discern groundwater levels throughout the project area. Groundwater generally occurs in numerous sub-basins throughout the Central Valley. Relatively uniform, unconfined aquifers and associated water tables occur within this valley. Groundwater is routinely

pumped for domestic and agricultural purposes and is therefore subject to long-term changes in water levels due to overdraft and recharge conditions. Seasonal groundwater fluctuations are common and typically controlled by neighboring water courses.

2.2.5 Oil and Gas Fields

Oil and gas maps produced by the California Geologic Survey (CGS) for the Division of Oil and Gas (DOG) and have been digitized into GIS layers for the entire state (DOG, 2001), as shown on Plate 5. Oil and gas fields exploit subsurface deposits of hydrocarbons trapped within permeable zones along faults and within upwarped or domed geologic structures. These oil fields generally occur in two main areas including the southern Bakersfield Basin and the fields in the region west of Stockton-Sacramento. Sources of information for both mineral resources and oil/gas resources were available through CGS. Maps and publications are available through their website.

The major issue associated with oil, gas, and geothermal resources is the exclusion of future resource availability caused by the placement of facilities (railroad track, roadways, parking areas). Additionally, subsurface oil and gas deposits could impact the construction and operation of the Project Alternatives. Potential impacts on oil, gas, or geothermal resource availability were evaluated based on a comparison of known resource location versus facility location. Potential resources were identified from published resource maps produced by the California Department of Conservation - Division of Oil, Gas, and Geothermal Resources (CDC 2001a, CDC2001b).

2.2.6 Mineral Resources

Mineral resources have been mapped by the United States Geologic Survey (USGS) for eleven of the western states and digitized in GIS format, as shown on Plate 6 (Frank, 1999). Essentially all of these mineral resources occur east of the project area in the Sierra Nevada Foothills, with the exception of the sand, gravel, and clay deposits in the Stockton-Sacramento area. These sand and gravel deposits are mined in open-pit quarries, generally to the water table, and exploited for concrete and other construction materials. While some clay deposits are mined for construction, most are mined for brick, pottery, and other refractory products.

2.2.7 Potentially Unstable Slopes/Land sliding

No potentially unstable slopes meeting these criteria were mapped within the project area, as shown on Plate 10. While statewide maps showing existing landslides were not available for this analysis, there is little or no potential for landslide within the region due to the flatness of the valley topography.

2.2.8 Difficult Excavation Areas

As shown on Plate 11, there are no areas within the Sacramento to Bakersfield region where difficult excavation is anticipated to be encountered. Further, no tunneling is proposed within this region so difficult excavation is not considered a significant factor in the evaluation of Project Alternatives.

2.3 SOILS

Soil units mapped by the USDA National Resource Conservation Service (NRCS) provide information only for near-surface conditions. Plate 4 shows the distribution of the mapped soil units in relationship to the proposed alignments and station alternatives. These maps were prepared by the USDA on the basis of shallow (maximum 6.5 feet deep) hand auger borings or test pits. The distribution of these soil units is highly variable along the alignments.

2.3.1 Corrosive Soils

Soils can contain low pH and/or high sulfate concentrations that can adversely influence proposed surface and subsurface improvements. Low pH soils can severely deteriorate buried metal pipelines and other metallic improvements. High sulfate content soils can deteriorate concrete and prevent complete curing of concrete, reducing its strength considerably. These soil units generally coincide with saline soils such as playas and evaporite deposits that may occur within the project area. Generalized extent of these areas can be mapped using pH and resistivity properties contained in soil parameter tables and used in conjunction with this soil unit GIS layer. This can be performed at a later stage in the project when a more refined project plan and design are available.

2.3.2 Erosion

Soils can contain very little fine-grained soil fraction and may be low in density, rendering them more susceptible to erosion when exposed to high velocity flow of water or severe wind conditions. These soil units generally coincide with permeable and low-density soils such as young alluvium and other surficial deposits that may occur within the project area. Generalized extent of these areas can be mapped using USCS (Unified Soil Classification System) symbols describing the composition of soils and erodibility values contained in the soil parameter tables used in conjunction with this soil unit GIS layer. This can be performed at a later stage in the project when a more refined project plan and design are available.

2.3.3 Shrink-swell

Soils can contain high concentrations of clay that are susceptible to shrink and swell when wetted or allowed to dry. Severe shrinkage or swelling can damage adjacent and overlying foundations and other surface improvements. These soil units generally coincide either with broad floodplain sediments that tend to be more clayey due to their distance of transport and also occur as a result of weathering of the surface of other geologic units as soil profiles. These conditions may occur within the project area. Generalized extent of these areas can be mapped using USCS symbols and plasticity and liquid limit values contained in the soil parameter tables used in conjunction with this soil unit GIS layer. This can be performed at a later stage in the project when a more refined project plan and design are available.

2.4 SEISMIC HAZARDS

Seismic hazards are present where faults capable of generating earthquakes with potential for ground rupture, strong ground motion, liquefaction, or other seismically-related ground movements or deformation. Each of these hazards is described more thoroughly below along with a description of their potential occurrence.

2.4.1 Regional Faulting and Historic Seismicity

Faulting is prevalent throughout California, resulting in its intense seismicity when compared to other parts of the country. California generally categorizes a fault as capable of future movement if there is evidence that the fault has moved within the past 10,000 years (i.e. Holocene) and defines this category of faults as "Active". Faults with movement within the past 1.6 million years (i.e. Quaternary) and no known Holocene displacement are considered moderately capable of rupture and are categorized as "Potentially Active". Faults older than 1.6 million years are treated with the least concern and are called "Inactive". Essential or critical facilities to human health and safety are required to recognize the potential for ground rupture on or immediately adjacent to both Active and Potentially Active Faults. Plate 7 presents Quaternary Faults and Alquist-Priolo Earthquake Fault Zones as compiled from the Fault Activity Map of California (Jennings, 1994) and Alquist-Priolo (AP) Earthquake Fault Zones of California (CGS, 2002). The only fault crossings of consequence within the study area are the north and south segments of San Joaquin Fault, located in the northwest portion of the Sacramento to Bakersfield region, near Stockton. The San Joaquin Fault is considered capable of generating an earthquake of around

magnitude 6.5 and could result in 0.8 meters of displacement (CGS website, 2003). AP mapping represents those zones where CGS considers faults to be present, requiring further site-specific fault studies and recommendations prior to development. These zones generally include faults with known movement within the past 10,000 years (i.e. Holocene).

2.4.2 Ground Rupture Potential

Ground rupture occurs when a fault ruptures at depth and movement along the fault propagates to the ground surface. The potential for ground rupture is typically estimated based upon the presence of faults with known displacement during recent geologic time. The only fault crossing with significant ground rupture potential within the study area is the San Joaquin Fault.

2.4.3 Ground Motion Potential

Ground motion occurs when faults rupture at depth, where pressures are high, resulting in earthquakes. The future potential for seismicity within the project area will be controlled by the behavior of faults within and adjacent to this region. Plate 8, generated from CGS and USGS maps that indicate the probability of occurrence of seismic ground motions (USGS, CGS, 1996) within the Sacramento to Bakersfield region. These maps are the result of running computer models that consider the fault recency of movement and slip rate as well as documented (historic) seismicity defining future ground motions on the basis of probability of occurrence. Generally speaking, this model relates each of the recognized faults considered capable of generating earthquakes during the near future and decreases, or attenuates, the ground shaking with distance away from the fault. The probability of occurrence is provided in three probability scenarios including the Design Basis Event (10% probability of exceedance in 50 years), the Upper Bound Event (10% probability of exceedance in 100 years), and the Maximum Conceivable Event (10% probability of exceedance in 250 years). The State requires that essential and critical public facilities be designed to mitigate against catastrophic failure based on the Upper Bound Event, or UBE.

Within the Central Valley, this region is generally characterized as having a 15-20% chance of UBE within 100 years. At the foothills of the Coastal and Tehachapi ranges, this probability increases to up to 60-70% and 30-40%, respectively, within the project area.

2.4.4 Liquefaction and Seismically Induced Ground Deformation

Liquefaction and other ground deformation are the result of ground motions, where localized subsurface earth unit conditions are susceptible to collapse or flow. Liquefaction is a seismic-induced soil condition in which loose, saturated, granular (i.e. sandy) soils behave like a fluid when subjected to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: 1) shallow groundwater, 2) low-density sandy soils, and 3) high-intensity ground motion. Although liquefaction has occurred in areas where fine-grained soils exist, studies have demonstrated that the most severe and most common liquefaction occurs in areas of granular soils. Effects of liquefaction on level ground include sand boils, settlement, and bearing capacity failures below structural foundations. Groundwater contours for the entire project study areas was not available with reasonable accuracy that would be beneficial to this preliminary evaluation. Therefore, in the absence of this information and for purposes of this project, all areas were assumed potentially underlain by shallow groundwater. This allowed mapping of potentially liquefiable zones by including areas where ground motions exceed 30% (i.e. 0.30) g but excluding areas mapped as underlain by rock. Limits of potentially liquefiable zones within the region are mapped on Plate 9. Except for the much of the length of I-5, which lies in a potentially liquefiable area, the study is outside of liquefaction potential regions.

2.4.5 Tsunami and Seiche

Tsunamis are oceanic waves that are generated by earthquakes, submarine volcanic eruptions, or large submarine landslides. The waves are generally formed in groups that may have very long wavelengths (several to more than 100 miles), but only a few feet high. As a tsunami enters shallow water near coastlines, the wave velocity diminishes and the wave height increases. If the trough of the wave reaches land first, the arrival of a tsunami is preceded by a recession of coastal waters; if the crest of the wave reaches land first, there would be a rise in water level. The large waves that follow can crest at heights of more than 50 feet and strike with devastating force.

For the Sacramento to Bakersfield segment the nearest shoreline is more than 25 km away. The potential tsunami hazard within the region, therefore, is considered low to nil.

A seiche is a standing wave condition whereby large bodies of water when subjected to seismic accelerations can generate significant waves that overtop the basin boundaries. Large bodies of water within or near the Sacramento-Bakersfield segment of the project alternatives include O'Neill Forebay and Melga Reservoirs. These reservoirs are owned, operated, and maintained by various State and Federal agencies such as the US Army Corps of Engineers, US Bureau of Reclamation, and Department of Water Resources. These jurisdictional agencies perform regular facility conditions and design reviews relative to seismic, hydrologic, and geotechnical performance given current state of the practice. These dam and reservoir reviews include the analysis of seiche impacts and result in retrofitting where necessary. In view of these requirements, these reservoirs are not expected to adversely influence the proposed project alternatives.

3.0 METHODOLOGY FOR GEOLOGY AND SOILS

The proposed HST and Modal Alternative were evaluated by comparing conditions and/or potential impacts including seismic hazards, active fault crossings, potentially unstable slopes, difficult excavation areas, potential gas migration from oil and/or gas fields, and mineral resources. The No-Project Alternative consists of localized highway and airport improvements, which can have some local environmental impacts, which may need mitigation. However, it is not useful or meaningful to quantify such impacts at this statewide programmatic level. Criteria for geographic delineation of the potential hazards and/or conditions for the Modal and HST Alternatives are described in previous sections. Soil conditions have been described previously in Baseline/Affected Environment (Section 2.0) but are not included in the methodology. These conditions include expansive soils (i.e. shrink-swell potential), erosion, and corrosivity. These conditions are proposed to be addressed in Subsequent Analysis Requirements, as outlined in Section 5.0 and are not considered to be of significant impact to the preliminary planning and environmental analysis of the project alternatives. Similarly, tsunamis and seiche are discussed in Section 2.4.5 but were not considered significant to the project and were not included in our ranking methodology. The methodology used to compare project alternative, alignments, and stations are outlined below. The results of these comparisons are summarized in Section 4.0

3.1 SEISMIC HAZARDS

Seismic hazards have been evaluated by combining the influences of strong ground motion and liquefaction potential. These potential hazards are discussed previously in Sections 2.4.3 and 2.4.4. Strong ground motion zones have been defined as areas where horizontal peak ground accelerations may exceed 50% (i.e. 0.50) g. The aerial extent of the project within these strong ground motion zones is shown on Plate 9. Liquefaction potential has been defined as those areas where ground motions exceed 30% (i.e. 0.30) g but excluding areas mapped as underlain by rock. Those areas are shown on Plate 9. In order to compare alternative projects (i.e. Modal versus HST), alignments, and stations, a ranking system was developed. This ranking system consists of the combination of the percentage of portions of the alignment within the strong ground motion zones or potentially liquefiable zones. Overlapping liquefaction/ground motion hazards are not considered duplicative in that they do not require unique mitigation effort. Stations were compared by determining whether any portion of the proposed station occurs within the ground rupture zone and a yes or no ranking, or:

Alignments - % in Strong Ground Motion Zone or in Potentially Liquefiable Zones
Stations - Presence of any Part within either Zone: Yes / No

3.2 ACTIVE FAULT CROSSINGS

Faulting within the study area has been evaluated on the basis of the most recent known age of faulting, and recency of activity. For purposes of this project, Quaternary fault crossing zones are defined as areas where Quaternary faults transect any portion of the alignment including a 200-foot study area allowing for other improvements associated with the project and still influenced by ground rupture potential. The aerial extent of the project within these active fault zones is shown on Plate 7. In order to compare alternative projects (i.e. Modal versus HST), alignments, and stations, a ranking system was developed. Any fault crossings were counted for each of the tabulated segments for comparison. This ranking system consists of the number of fault crossings within any portion of the alignment and a yes or no rating for stations, or:

Alignments - Number of Active Fault Crossings
Stations - Presence of any Part within Zone: Yes / No

3.3 SLOPE STABILITY

Slope instability can require stabilization planning, design, and construction costs and, if not adequately characterized and mitigated during construction, can cause severe damage to surface and near-surface improvements. Typically, site-specific studies are undertaken to address subsurface conditions and perform quantitative analysis of slope stability and design of mitigation measures where necessary. Since this evaluation precedes the availability of a design, a more general approach was taken. Each of the geologic formations mapped by Jennings (1977, 1991) and depicted on Plate 3 were assigned a formational rating for slope stability (low meaning relatively stable formational characteristics relative to potential for slope failure). The potentially unstable formations were then compared to the Digital Elevation Model (DEM) that has been queried for slope areas flatter than and steeper than 33% slope gradient.

For purposes of this project, the criteria for mapping potentially unstable slopes was all areas in which slope gradients exceed 33% and are not underlain by rock units having high strength characteristics (i.e. low instability ratings). A 200-foot wide study area around these potentially unstable areas was created to take into consideration other site improvements that may be influenced as well. These areas are shown on Plate 10. In order to compare Project Alternatives (i.e. Modal versus HST), a ranking system was developed in which the percentage of alignment within the potentially unstable zones are computed and compared. Stations were compared by determining whether any portion of the proposed station occurs within the potentially unstable slope areas with the 200-foot study area and a yes or no ranking, or:

Alignments - % within Potentially Unstable Zones
Stations – Presence of any Part within 200-foot Buffer Zone: Yes / No

3.4 DIFFICULT EXCAVATION

Difficult excavation areas have been addressed relative to surface excavation characteristics. Each of the geologic formations mapped by Jennings (1977, 1991) and depicted in Plate 3 were assigned a formational rating for hardness and thus excavatability using surface methods. Difficult excavation zones have been identified using both geologic formation characteristics as well as the existence of faults of any age. These areas are shown on Plate 11. These zones consist of fault zones that may influence subsurface tunneling methods and also hard rock zones that may influence surface excavation methods. Some hard rock formations may contain rock that is too hard to tunnel with tunnel boring machine (TBM) and may require mining and blasting; however, no tunnels are anticipated within the Sacramento to Bakersfield region.

In order to compare Project Alternatives (i.e. Modal versus HST), a ranking system was developed in which the percentage of alignment within the areas of difficult excavation applied to the corresponding track profile (i.e. at-grade/aerial versus tunnel) was computed and compared. Single fault crossings were assumed to be 200 meters wide. Stations were evaluated by determining the presence of any part of the facility within the zone and a yes or no rating, or:

Alignment - % Surface Segments in Hard Rock plus % Tunnel Segments within Fault Zones
Stations – Presence of any Part within either Zone: Yes / No

3.5 OIL AND GAS FIELDS

Areas of potential gas migration and the potential loss of valuable resources associated with the presence of known oil and gas fields and are distributed as shown on Plate 5. In order to compare alternative projects (i.e. Modal versus HST), alignments, and stations, a ranking system was developed in which the percentage of alignment within these oil and gas field areas were compared. Stations were compared by

determining whether any portion of the proposed station occurs within the mapped oil and gas field areas as a yes or no ranking, or:

Alignments - % within Mapped Oil and Gas Fields
Stations – Presence of any Part within either Fields: Yes / No

3.6 MINERAL RESOURCES

The major issue associated with mineral resources is the exclusion or restriction of current or future extraction due to facility (railroad track, roadways, parking areas) location. Potential impacts on mineral extraction were evaluated based on a comparison of known resource location versus facility location. Areas of potential mineral resources are shown on Plate 6. In order to Project Alternatives (i.e. Modal versus HST), a ranking system was developed in which the number of occurrences of mined mineral resources were compared for alignments. Stations were compared by determining whether any portion of the proposed station occurs within the mapped resources as a yes or no rating, or:

Alignments - # of Mapped Resources within 200-feet
Stations – Presence of Resources within 200-feet of any Part of Proposed Facilities

10 PAGES OF PLATES

PAGES 16 THROUGH 25

4.0 GEOLOGICAL IMPACTS

Table 1
Geology and Soils
Impact Analysis Summary Table
Sacramento to Bakersfield

	Seismic Hazards ¹	Active Fault Crossings ²	Slope Stability ¹	Difficult Excavation ¹	Oil and Gas Fields ¹	Mineral Resources
No-Project						
Modal Alternative						
Sacramento to Stockton						
I-5: I-80 to Stockton	0	0	0	0	3	Not Present
SR99: Sacramento to SR120	0	0	0	0	1	Not Present
Sacramento Airport	Not Present	Not Present	Not Present	Not Present	Present	Not Present
Stockton to Modesto						
I-5: Stockton to I-580/SR120	30	2	0	0	7	Not Present
I-5: I-580/SR120 to SR152	100	2	0	0	0	Not Present
SR99: SR120 to Modesto	0	0	0	0	0	Not Present
Modesto to Merced						
SR99: Modesto to Merced	0	0	0	0	0	Not Present
Merced to Fresno						
SR99: Merced to SR152	0	0	0	0	0	Not Present
SR99: SR152 to Fresno	0	0	0	0	0	Not Present
I-5: SR152 to Fresno	1	0	0	0	0	Not Present
Fresno Airport	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Fresno to Tulare						
I-5: Fresno to Tulare	1	0	0	0	0	Not Present
SR99: Fresno to Tulare	0	0	0	0	0	Not Present
Tulare to Bakersfield						
I-5: Tulare to SR99	1	2	0	0	3	Not Present
SR99: Tulare to SR58	0	0	0	0	8	Not Present
HST Alternative (see Appendix A for Alignment Options)						
Sacramento to Stockton						
<u>Alignments</u>						
A1	0	0	0	0	2	Present
A2	0	0	0	0	3	Present
A3	0	0	0	0	3	Present
A4	0	0	0	0	2	Present
A5	0	0	0	0	3	Present
A6	0	0	0	0	3	Present
A7	0	0	0	0	3	Present
A8	0	0	0	0	3	Present
<u>Stations</u>						
Sacramento Downtown Depot	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Power Inn Road Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present

	Seismic Hazards ¹	Active Fault Crossings ²	Slope Stability ¹	Difficult Excavation ¹	Oil and Gas Fields ¹	Mineral Resources
Stockton Downtown Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
<u>Maintenance Facilities</u>						
Sacramento Maintenance Facility BNSF Alt	Not Present	Not Present	Not Present	Not Present	Not Present	Present
Sacramento Maintenance Facility UPRR Alt	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Stockton to Modesto						
<u>Alignments</u>						
B1	0	0	0	0	0	Not Present
B2	0	0	0	0	0	Not Present
<u>Stations</u>						
Modesto Downtown Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Modesto Briggsmore Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Modesto to Merced						
C1	0	0	0	0	0	Not Present
C2	0	0	0	0	0	Not Present
C3	0	0	0	0	0	Not Present
C4	0	0	0	0	0	Not Present
C5	0	0	0	0	0	Not Present
C6	0	0	0	0	0	Not Present
C7	0	0	0	0	0	Not Present
C8	0	0	0	0	0	Not Present
C9	0	0	0	0	0	Not Present
C10	0	0	0	0	0	Not Present
C11	0	0	0	0	0	Not Present
C12	0	0	0	0	0	Not Present
C13	0	0	0	0	0	Not Present
C14	0	0	0	0	0	Not Present
C15	0	0	0	0	0	Not Present
C16	0	0	0	0	0	Not Present
<u>Stations</u>						
Merced Downtown Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Merced Municipal Airport Station	Not Present	sent	Not Present	Not Present	Not Present	Not Present
Castle Air Force Base Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Merced to Fresno						
<u>Alignments</u>						
D1	0	0	0	0	0	Not Present
D2	0	0	0	0	0	Not Present
D3	0	0	0	0	0	Not Present
D4	0	0	0	0	0	Not Present
D5	0	0	0	0	0	Not Present
D6	0	0	0	0	0	Not Present
D7	0	0	0	0	0	Not Present
D8	0	0	0	0	0	Not Present

	Seismic Hazards ¹	Active Fault Crossings ²	Slope Stability ¹	Difficult Excavation ¹	Oil and Gas Fields ¹	Mineral Resources
<u>Stations</u>						
Fresno Downtown Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Fresno to Tulare						
<u>Alignments</u>						
E1	0	0	0	0	0	Not Present
E2	0	0	0	0	0	Not Present
<u>Stations</u>						
Visalia Airport	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Hanford Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Tulare to Bakersfield						
<u>Alignments</u>						
F1	0	0	0	0	8	Not Present
F2	0	0	0	0	4	Not Present
F3	0	0	0	0	8	Not Present
F4	0	0	0	0	4	Not Present
F5	0	0	0	0	7	Not Present
F6	0	0	0	0	4	Not Present
F7	0	0	0	0	8	Not Present
F8	0	0	0	0	4	Not Present
F9	0	0	0	0	8	Not Present
F10	0	0	0	0	4	Not Present
F11	0	0	0	0	7	Not Present
F12	0	0	0	0	4	Not Present
F13	0	0	0	0	5	Not Present
F14	0	0	0	0	5	Not Present
F15	0	0	0	0	10	Not Present
F16	0	0	0	0	7	Not Present
F17	0	0	0	0	10	Not Present
F18	0	0	0	0	7	Not Present
F19	0	0	0	0	13	Not Present
F20	0	0	0	0	10	Not Present
F21	0	0	0	0	13	Not Present
F22	0	0	0	0	10	Not Present
F23	0	0	0	0	10	Not Present
F24	0	0	0	0	7	Not Present
<u>Stations</u>						
Bakersfield Airport Station	Not Present	Not Present	Not Present	Not Present	Present	Not Present
Golden State Station	Not Present	Not Present	Not Present	Not Present	Present	Not Present
Truxtun (Amtrak) Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Truxtun (Union Avenue) Station	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
<u>Maintenance Facilities</u>						
Main Maintenance Facility BNSF Alt	Not Present	Not Present	Not Present	Not Present	Present	Not Present

	Seismic Hazards ¹	Active Fault Crossings ²	Slope Stability ¹	Difficult Excavation ¹	Oil and Gas Fields ¹	Mineral Resources
Main Maintenance Facility UPRR Alt	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present

4.1 IMPACTS

For the Soils and Geology technical report, impacts are described for both construction and operations. Construction impacts are those having the potential to be encountered during construction or mitigated during construction – such as difficult excavation, or soil densification for liquefiable soils. Operational impacts are those that may need to be mitigated or inspected through the life of the project – such as creeping faults or slopes.

Six potential impacts to operations and construction of the Project Alternatives were considered. These include: seismic hazards, active fault crossings, slope stability, difficult excavation, oil and gas fields, and mineral resources. These potential impacts and mitigation measures are discussed in the following sections.

4.1.1 No-Project Alternative

Compared to the more extensive Modal and HST Alternatives, the No-Project Alternative would trigger less environmental impact. Nonetheless, this statement is not intended to suggest that the No-Project would not have adverse effects. In fact, it is anticipated that collectively the various improvements programmed and funded in the State Transportation Improvement Program, Regional Transportation Plans, Airport Master Plans, and intercity passenger rail plans would have impacts, many of which will require mitigation measures to reduce the effects in their local areas. Within the 270-mile length of the Sacramento to Bakersfield Region, however, a precise quantification of these local impacts is not feasible at this level of analysis and would not be meaningful as a point of comparison to the overall evaluation of the Modal and HST Alternatives.

4.1.2 Modal Alternative

Seismic Hazards

The Modal Alternative has some medium and high probabilities of seismic hazards on its route along the western edge of the Central Valley, where portions of the I-5/Modal Highway alignment reach ground motions of up to 70%g. The portion of the proposed Modal Alignment in the Central Valley that is influenced by this potential impact is along I-5 between I-5/I-580 near Tracy to the North and Kettleman City at the South (Stockton to Modesto, Modesto to Merced, and Merced to Fresno corridors). This condition may influence the construction or operation of roads, trains, and airports in the following respects:

- Potential risk to worker safety due to collapse or toppling of partially constructed facilities during strong earthquakes
- Potential risk to public safety due to automobile accidents caused by ground motion during strong earthquakes
- Potential risk to public safety due to collapse or toppling of facilities during strong earthquakes

Active Fault Crossings

The San Joaquin Fault, which occurs along the northern end of the I-5 highway component of the Modal Alternative in the vicinity of its intersection with SR-152 and the northern segment near Tracy (within the Stockton to Modesto corridor), is the only Quaternary fault crossing influencing this region. The presence of this fault may influence the construction or operation of the affected highway improvements in the following respect:

- Potential risk to worker safety and interruption of construction due to failure of natural and/or construction cuts slopes or retention structures
- Potential risk to worker safety due to ground rupture along active faults
- Potential risk to public safety due to damage to highway or airport by ground rupture along active faults

Slope Stability

Potentially unstable slopes and/or formations, where proposed cut slopes or retention structures may require stabilization, occur along the I-5 segment of the Modal Alternative from the intersection of I-5/I-580 near Tracy to just south of its intersection with SR-152 (Stockton to Modesto and Modesto to Merced corridors). Relative to other segments and alignments of the project slope stability hazards are considered minor for this region; however, the presence of unstable slopes may influence the operations of the roads and airports in the following respects:

- Potential risk to public safety and operation of roads and airports due to failure of natural and/or construction cut slopes or retention structures.

Difficult Excavation

Because there are no areas of anticipated difficult excavation, this condition is not anticipated to influence operations or construction of the Modal Alternative in this region.

Oil and Gas Fields

Several oil fields occur within the Modal Alternative study area in Sacramento to Stockton area and in the Bakersfield area. The potential for migration of oil and/or gas in the Stockton-Sacramento and Bakersfield areas may result in the following issues:

- Migration of potentially explosive and/or toxic gases into subsurface facilities.

Mineral Resources

Significant mineral resources were not identified along the Modal Alternative highway or airport component. Therefore, this condition is not expected to impact the operation of the Modal Alternative facilities.

4.1.3 High-Speed Train Alternative

Seismic Hazards

Seismic hazards, including ground motion, liquefaction, and other seismically induced ground movement, are considered relatively minor for the HST operations in the Central Valley when compared to other regions and segments in California. All of the HST alignments are within a low ground motion potential region (i.e. <25%g) with the exception of the southern end in the Bakersfield area where ground motion is up to 40%g, where this condition is present for less than 10% of the alignment length. There is little differentiation of potential for seismic hazard among the HST alignment options, all of which have a Low potential for seismic hazard.

Active Fault Crossings

No active faults intersect or cross the proposed HST and are therefore not expected to influence the construction or operation of the HST in this region.

Slope Stability

No areas of potential unstable slopes occur along the HST Alternative within this region. Therefore, impact on the operation or construction of the HST is not anticipated.

Difficult Excavation

There are no areas of anticipated difficult excavation along any of the proposed HST alignments or stations in this region. Therefore, this condition is not anticipated to influence operation of the HST in this region.

Oil and Gas Fields

Areas where potential for subsurface migration of oil and gas occur in the HST Alternative study area within the Sacramento to Stockton corridor and in Bakersfield. Oil and gas fields principally affect the following alignment segments: along the UP alignment near the Stockton Downtown Station site, along the UP alignment and between the Bakersfield Airport and Golden State Station sites, along the BNSF alignment north of the Truxtun (Amtrak) Station site, and at the SR58 connection to the Bakersfield to Los Angeles Region. The full length of the UP loop around Tulare is potentially impacted by oil and gas fields. The UP Oildale connector, which serves as an off-line station loop to the Truxtun (Amtrak) Station under HST options F19 through F22, has a Medium potential for impact under this criterion. There is considered, however, an overall Low potential for hazards resulting from oil and gas fields for the HST Alternative alignments.

The Stockton Downtown Station, Bakersfield Airport Station, and Bakersfield Golden State Station sites are potentially affected by the presence of oil and gas fields, where the potential impact is considered High.

Similar to the Modal Alternative, the potential for migration of oil and/or gas in the Sacramento-Stockton and Bakersfield areas may result in the following issues:

- Migration of potentially explosive and/or toxic gases into subsurface facilities.

Mineral Resources

There are several areas where mineral resources have been identified to occur along the proposed HST alignment and/or stations. The presence of mineral resources may impact the construction of the following HST alignment and station options, where the potential impact is rated High: Sacramento Downtown Station, Sacramento Power Inn Road Station, and all Sacramento-Stockton alignment options. The presence of mineral resources is most considerable in the Sacramento area and will impact all HST alignment options in the Sacramento to Stockton corridor to some extent.

This condition may influence construction of the HST in the following respects:

- Project costs and schedule associated with abandonment and/or closure requirements for existing resource facilities including potential remediation.
- Potential loss of valuable mineral resources

4.1.4 High-Speed Train Alternative

Impact: Migration of potentially explosive and/or toxic gases into subsurface facilities.

Construction areas where potential migration of hazardous gases may occur due to the presence of oil fields, gas fields, or other potential sources of hazardous gases can be mitigated by installation of relief wells, proper ventilation, and careful monitoring. Review of historical records and field investigation

methods to identify and delineate these sources during the design of the project will allow appropriate mitigation.

Impact: Project costs and schedule associated with abandonment and/or closure requirements for existing resource facilities including potential remediation

Mineral resources represented in this evaluation represent existing mineral resource sites. The presence of these sites within or immediately adjacent to the project alignment/stations may indicate that abandonment and/or closure is required prior to project construction. This could adversely impact the project schedule and/or cost estimate. This can be mitigated by early anticipation of these locations by detailed review of historic records and agency communication regarding closure requirements. If this impact cannot be mitigated by avoidance (i.e. realignment) remediation requirements would need to be completed prior to construction.

Impact: Potential loss of valuable mineral resources

In some cases, mineral resource sites may represent valuable materials that must either be completely developed prior to abandonment/closure or avoided by the project due to delay/cost to accommodate and re-alignment agency requirements. This could result in realignment of proposed HST alignments and/or relocation or modification to proposed stations. In order to mitigate the potential for significant project re-design, these sites and their associated requirements should be identified as early as possible.

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6.0 PREPARERS

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APPENDICES

APPENDIX – A

Corridor and Design Options for High-Speed Train Alternative

CORRIDOR AND DESIGN OPTIONS FOR HIGH-SPEED TRAIN ALTERNATIVE

SACRAMENTO TO BAKERSFIELD

Corridor Definition

The Central Valley region has been divided into six discrete corridors:

Corridor A, Sacramento to Stockton

Corridor B, Stockton to Modesto

Corridor C, Modesto to Merced

Corridor D, Merced to Fresno

Corridor E, Fresno to Tulare

Corridor F, Tulare to Bakersfield

Design Options

There are two or more HST alignment alternatives within each Corridor, distinguished by parallel route (UPRR or BNSF), station site served, route connection (UPRR or BNSF) to the south, and station configuration (off-line "loop" or standard). HST alternatives are shown on the alignment exhibits in this Appendix.

Within the Sacramento to Bakersfield region, the HST project would be built primarily at-grade. With the exception of specific and localized grade separations, which may include structures to carry the HST alignment over existing roadway or railroad facilities, proposed aerial structures within the Central Valley would include those listed below. The specific location, number, and length of structures will be determined during the next phase of design.

Aerial Structure Locations			
HST Alignment Option(s)	Aerial Structure Location	Approximate Limits	Length (ft)
Corridor A			
Sacramento Depot alignments: A1 thru A4	Sacramento	Sacramento Downtown Depot to the Elvas Wye	17,000
Sacramento Depot alignments parallel to UPRR north of Stockton: A1, A3	Sacramento	Folsom Blvd to 14 th Avenue	6,000
All alignments: A1 thru A8	Stockton	Harding Way to Mormon Slough	7,000
Corridor B			
Modesto Downtown Station alignment: B1	Modesto	Kansas Avenue to Tuolumne River	9,000
Modesto Briggsmore Station alignment: B2	Escalon	Yosemite Avenue to St. John Road	5,000
Modesto Briggsmore Station alignment: B2	Riverbank	South of Patterson Road to Claribel Road	7,000
Corridor C			
All alignments parallel to UPRR north of Merced: C1, C2, C3, C4, C9, C10	Turlock	Broadway to Berkeley Avenue	12,000

Aerial Structure Locations			
HST Alignment Option(s)	Aerial Structure Location	Approximate Limits	Length (ft)
All alignments parallel to UPRR north of Merced: C1, C2, C3, C4, C9, C10	South of Delhi	High Fine Canal to Merced River	8,000
All alignments parallel to UPRR north of Merced: C1, C2, C3, C4, C9, C10	Atwater	Atwater Canal/Jordan Canal to SR99 Overpass	13,000
Corridor D			
All alignments parallel to UPRR north of Fresno: D5, D6, D7, D8	Madera	Fresno River to Olive Avenue	8,000
All alignments: D1 thru D8	Fresno	Ashlan Avenue to Clinton Avenue	12,000
All alignments: D1 thru D8	Fresno	Belmont Avenue to SR180 Overpass	4,000
Corridor E			
Visalia Airport Station alignment: E1	Selma	Floral Avenue to Nebraska Avenue	8,000
Hanford Station alignment: E2	Hanford	11 th Avenue to south of 3 rd Street	6,000
Corridor F			
All alignments thru Tulare: F1, F2, F7, F8, F13, F15, F16, F19, F20	Tulare	Prosperity Avenue/Avenue 240 to Bardsley Avenue	11,000
All alignments parallel to UPRR north of Bakersfield: F1 thru F4, F7 thru F10, F13 thru F22	Delano	Cecil Avenue to High Street	8,000
All alignments parallel to BNSF north of Bakersfield: F5, F6, F11, F12, F23, F24	Corcoran	Orange Avenue to Pickerell Avenue	6,000
All alignments parallel to BNSF north of Bakersfield: F5, F6, F11, F12, F23, F24	Shafter	Tulare Avenue to Lerdo Highway	4,000
Truxtun (Amtrak) Station (without loop) alignments parallel to UPRR north of Bakersfield: F15 thru F18	Famoso	North of Poso Creek to south of SR99	16,000
Bakersfield Airport Station, Golden State Station, Truxtun (Union Avenue) Station, and Truxtun (Amtrak) Station (with high-speed loop) alignments: F1 thru F6, F7 thru F12 F13, F14, F19 thru F22	Bakersfield	North of Norris Road to Olive Drive	6,000
Bakersfield Airport Station, Golden State Station, Truxtun (Union Avenue) Station, and Truxtun (Amtrak) Station (with high-speed loop) alignments: F1 thru F6, F7 thru F12 F13, F14, F19 thru F22	Bakersfield	Beale Avenue to Mount Vernon Avenue	7,000
Truxtun (Amtrak) Station alignments: F15 thru F24	Bakersfield	North of Mohawk Street to Carrier Canal	8,000
Truxtun (Amtrak) Station alignments: F15 thru F24	Bakersfield	F Street to Truxtun Avenue	14,000